

JAPANESE

[JP,11-055747,A]

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE  
INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS

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**CLAIMS**

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[Claim(s)]

[Claim 1] In the wireless packet transmission approach which adopted the PRMA approach of transmitting a wireless packet only when there are data transmitted by the system which consists of at least one mobile station which considers radio as two or more base transceiver stations and them, and there is an usable wireless slot and packet sending-out authorization is given Although there are data which should be sent out, in order that there may be no usable wireless slot, when a wireless packet cannot be transmitted, Even if it judges whether it is in the location where a mobile station can communicate with other base transceiver stations and there is a base transceiver station which can communicate, when there is no usable slot or packet sending-out authorization is not obtained, same actuation is performed to the base transceiver station of further others. It is the wireless packet transmission approach characterized by trying sending out of the above-mentioned data packet for every frame of PRMA as long as there are data which should be sent out, when there is a base transceiver station which can communicate, an usable slot is in the base station and packet sending-out authorization is obtained.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]****[0001]**

**[Field of the Invention]** This invention is the system by which a base transceiver station and a mobile station radiocommunicate using a wireless packet, reduces the rate of packet loss and relates to the system which communicates by utilizing effectively the frequency to which many mobile stations were restricted.

**[0002]**

**[Description of the Prior Art]** Until now, the point-to-multipoint connection technique of PRMA (Packet Reservation Multiple Access) applied to mobile communication is proposed. This is the U.S. society magazine IEEE. Trans.on VT, vol.40, No.1 It is David to Feb. and 1991. The paper of the title "Efficiency of Packet Reservation Multiple Access" is announced by J.Goodman and SherryX.Wei. The slot quota algorithm of the conventional technique based on this is shown in drawing 5 . Conventionally, in mobile communication, the mobile station chose the nearest base transceiver station, and was communicating by assigning a slot between the base transceiver station and mobile station in the procedure shown in coincidence. This was because high circuit quality can be acquired and a high throughput can be obtained especially in data communication by communicating with the nearest base transceiver station.

**[0003]**

**[Problem(s) to be Solved by the Invention]** In PRMA, if two or more mobile stations transmit a wireless packet to coincidence when a slot is vacant, it will be interfering (it interfering mutually). Consequently, neither of the wireless packets reaches a base station, but a slot, i.e., the use effectiveness of a frequency, falls. Packet sending-out authorization is given in order to avoid this. Interference becomes easy to occur, and when low, sending-out authorization of a wireless packet is not obtained easily, but the rate of loss of a packet is made to increase, if a packet sending-out authorization probability is high. Although it is desirable to make it change accommodative according to traffic as for this sending-out authorization probability, traffic changing to short paddle time amount a lot, and reporting that information to a mobile station from a base transceiver station serially causes the increment in the traffic by that information signal, and it is substantially difficult a probability. Therefore, to the traffic at that time, this packet sending-out probability could not send out a packet easily, when not the optimal, but the rate of packet loss was high.

**[0004]** Furthermore, when there was much traffic, even if it could obtain sending-out authorization, when there was no empty slot in the base transceiver station nearest to the mobile station, there was a problem that the rate of packet loss will increase without the ability transmitting data.

**[0005]** Then, the purpose of this invention is in mobile communication to offer the packet transmission approach of reducing the loss probability of a wireless packet.

**[0006]**

**[Means for Solving the Problem]** In actual mobile communication, in order to make high the rate of a location (rate of time amount) in which a communication link in the appointed area is possible, also in the edge of a cel, received power is designed with a margin so that it may

become to some extent higher than necessary received power. Moreover, as usually shown in drawing 1, it overlaps in the range where a cel is remarkable, and the area which two or more base stations cover exists. 1a is [ the service area of a base station 2 and 3a of the service area of a base station 1 and 1b ] the overlap area of service areas 1a and 1b in drawing 1.

[0007] This invention does not have an empty slot in a nearby base transceiver station or the chosen base transceiver station. Even when it is in the condition that data cannot be transmitted, and the existence of the base transceiver station which can otherwise communicate is investigated, there is a base transceiver station which can communicate and there is no it in a nearby base transceiver station, by communicating using the base transceiver station It is characterized [ main ] by aiming at an improvement of the above-mentioned rate of packet loss, and differs from the conventional technique in that a mobile station does not communicate with the not necessarily nearest base transceiver station. Since this will give the demand of the authorization which performs packet sending out to two or more base transceiver stations for a mobile station, the probability that the slot which can be sent out can be acquired goes up it. Moreover, since the slot which is vacant also as for each base station can gather the probability used by this approach, it leads to a deployment of a frequency.

[0008]

[Embodiment of the Invention] The first example of this invention is shown in drawing 2. When the packet which should be sent out in a mobile station or a base transceiver station arises, it writes in a buffer first and stores temporarily. Since the data with which time amount passed beyond the time amount defined beforehand in PRMA are discarded and serve as a loss packet, a buffer is good by the limited capacity which can perform the storage for time amount defined beforehand. When there are data in a buffer, i.e., the data which should be sent out, the slot for sending it out as a wireless packet is assigned. In drawing 2, actuation 100-124 is the same as actuation of drawing 5, and the actuation 130-136 enclosed with a dotted line is the description parts of this invention.

[0009] As shown in drawing 3, when the data which should be sent out have continued, if a certain slot is assigned, the data which continued using the slot succeedingly are sent out. When the data which should be sent out are lost temporarily, the slot is opened wide and other communication links are supplied with it. In this drawing, the data which a mobile station 1 should send out with a frame 2 were lost, and the mobile station 3 has sent out the wireless packet using the slot wide opened with the frame 3.

[0010] Although there are data which should be sent out here, there is no usable slot, or if the existence of the base transceiver station in which other communication links are possible is investigated and there is a base transceiver station which can otherwise communicate so that it may describe in the part of this invention in drawing 2 when assignment of a slot is not performed since sending-out authorization is not obtained, a slot will be assigned with the procedure of the usual PRMA. In migration communication system, in order to manage a mobile station, the control signal is usually transmitted continuously or intermittently. A mobile station is whether this signal is receivable, and can know the existence of the base transceiver station in which other communication links are possible.

[0011] In addition, also when there are data which should be sent out from a base transceiver station side to addressing to a mobile station, this invention can be applied by performing same processing by the network side.

[0012] The computer simulation result for checking the effectiveness of this invention to drawing 4 is shown. here — average packet continuation sending-out time amount =  $1 / 3$ -second, and average packet stop-time =  $1 / 2$  seconds, permission packet latency-time (upper limit of time amount which waits for sending out) = 15 frame, one-frame length = 8 ms, and the number of slots per frame (the number of users which can communicate to coincidence) — it was referred to as = 12. Although the rate of packet loss will increase rapidly the rate of packet loss in the conventional technique on this simulation condition if 20 or more users communicate, the increment in the rate of packet loss can be suppressed to 30 user extent in the system which applied this invention. For example, with the conventional technique, when the rate of packet loss to 2% is permitted, although even 24 twice as many users as the number of slots per frame

have held, this invention shows that even 31 about 3 times as many users as the number of slots per frame can hold now.

[0013] The above is applicable to other wireless packets, although it was application of this invention to PRMA which is the typical protocol of a packet communication mode.

[0014]

[Effect of the Invention] As explained above, in the system which performs wireless packet communication, by adding the procedure of investigating two or more base transceiver stations which can communicate, by this invention, it can use as it is, without changing packet communications protocols, such as PRMA which are other control procedures, and the increment in the rate of packet loss produced when traffic is high can be reduced. Furthermore, since the number of average empty slots decreases while the throughput of a packet improves, frequency use effectiveness becomes high.

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**TECHNICAL FIELD**

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[Field of the Invention] This invention is the system by which a base transceiver station and a mobile station radiocommunicate using a wireless packet, reduces the rate of packet loss and relates to the system which communicates by utilizing effectively the frequency to which many mobile stations were restricted.

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**PRIOR ART**

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**EFFECT OF THE INVENTION**

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[Effect of the Invention] As explained above, in the system which performs wireless packet communication, by adding the procedure of investigating two or more base transceiver stations which can communicate, by this invention, it can use as it is, without changing packet communications protocols, such as PRMA which are other control procedures, and the increment in the rate of packet loss produced when traffic is high can be reduced. Furthermore, since the number of average empty slots decreases while the throughput of a packet improves, frequency use effectiveness becomes high.

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**TECHNICAL PROBLEM**

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MEANS

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is drawing which explains a fundamental idea to be the background of this invention.

[Drawing 2] It is drawing showing the first example of this invention.

[Drawing 3] It is drawing explaining occupancy of a slot, and disconnection.

[Drawing 4] It is drawing showing the effectiveness of this invention quantitatively.

[Drawing 5] It is drawing explaining a Prior art.

[Description of Notations]

1 Base Station 1

1a The service area of a base station 1

2 Base Station 2

2a The service area of a base station 2

3 Mobile Station

3a Overlap area of service areas 1a and 1b

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[Translation done.]

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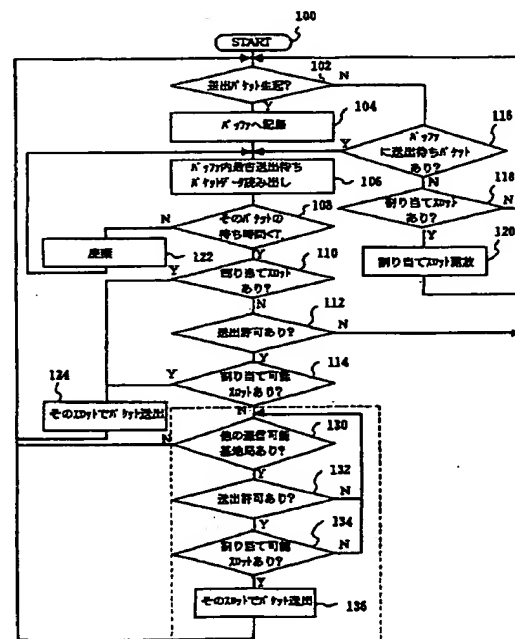
(74) 代理人 弁理士 山本 恵一

(54) 【発明の名称】 無線パケット伝送方法

(57) 【要約】

【課題】 無線パケット伝送において、パケットの喪失確率を低減するパケット伝送方法を提供する。

【解決手段】 最寄りの無線基地局、あるいは選択している無線基地局に空きスロットが無く、データの伝送が行えない状態の時に、他に通信可能な無線基地局の有無を調べ、通信可能な無線基地局がある場合に、それが最寄りの無線基地局で無い場合でも、その無線基地局を用いて通信を行うことにより、上記のパケット喪失率の改善を図る。



スロット及び基地局選択アルゴリズム

## 【特許請求の範囲】

【請求項1】 複数の無線基地局及びそれらと無線通信をする少なくとも1つの移動局からなる系で伝送するデータがあり使用可能な無線スロットがあり且つパケット送出許可が与えられた時にだけ無線パケットを送信するPRMA方法を採用した無線パケット伝送方法において、

送出すべきデータがあるが使用可能な無線スロットが無い為に無線パケットを送信できない場合、移動局が他の無線基地局と通信できる位置に居るかを判定し、通信可能な無線基地局があっても使用可能なスロットがないか或いはパケット送出許可が得られない場合には更に他の無線基地局に対し同様の操作を行い、通信可能な無線基地局があり、その基地局に使用可能なスロットがあり、パケット送出許可が得られた時は、送出すべきデータがある限りPRMAのフレーム毎に上記データパケットの送出を試みることを特徴とする無線パケット伝送方法。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、無線パケットを用いて無線基地局と移動局とが無線通信するシステムで、パケット喪失率を低下させ、多くの移動局が限られた周波数を有効に活用して通信を行うシステムに関する。

## 【0002】

【従来の技術】これまで、移動通信に適用する(Packet Reservation Multiple Access) PRMAという多元接続技術が提案されている。これは、米国学会誌IEEE Trans. on VT, vol. 40, No. 1 Feb., 1991にDavid J. GoodmanとSherry X. Weiによって“Efficiency of Packet Reservation Multiple Access”というタイトルの論文が発表されている。これに基づく従来技術のスロット割り当てアルゴリズムを図5に示す。従来、移動通信においては移動局が最も近い無線基地局を選択し、その無線基地局と移動局との間で、同時に示す手順でスロットの割り当てを行い、通信を行っていた。これは、最も近い無線基地局と通信することで、高い回線品質を得ることができ、特にデータ通信においては高いスループットを得ることができるからであった。

## 【0003】

【発明が解決しようとする課題】PRMAにおいて、スロットが空いたときに、複数の移動局が無線パケットを同時に送信してしまうと、混信(互いに干渉)となる。その結果、いずれの無線パケットも、基地局に届かず、スロット、即ち周波数の利用効率が低下する。これを避ける目的でパケット送出許可が与えられる。パケット送出許可確率が高いと混信が起きやすくなり、また低いと

なかなか無線パケットの送出許可が得られず、パケットの喪失率を増加させる。この送出許可確率は、トラヒックに応じて適応的に変化させることが望ましいが、トラヒックは短い時間に大きく変化し、その情報を逐次無線基地局から移動局へ報知することは、その報知信号によるトラヒックの増加を招き、実質的に困難である。従って、このパケット送出確率が、そのときのトラヒックに対して最適でないときには、パケットをなかなか送出できず、パケット喪失率が高くなっていた。

【0004】更に、トラヒックが多いときには、たとえ送出許可を得られたとしても、その移動局に最も近い無線基地局に空きスロットが無いとデータを送信することができずにパケット喪失率が増加してしまうという問題があった。

【0005】そこで、本発明の目的は、移動通信において、無線パケットの喪失率を低減するパケット伝送方法を提供することにある。

## 【0006】

【課題を解決するための手段】実際の移動通信では定められたエリア内での通信可能な場所率(時間率)を高くするために、セルの端においても受信電力は所要受信電力よりもある程度高くなるようにマージンを持って設計する。また、通常は図1に示すように、セルがかなりの範囲でオーバーラップし、複数の基地局がカバーするエリアが存在する。図1で1aは基地局1のサービスエリア、1bは基地局2のサービスエリア、3aはサービスエリア1aと1bのオーバーラップエリアである。

【0007】本発明は、最寄りの無線基地局、あるいは選択している無線基地局に空きスロットが無く、データの伝送が行えない状態の時に、他に通信可能な無線基地局の有無を調べ、通信可能な無線基地局がある場合に、それが最寄りの無線基地局で無い場合でも、その無線基地局を用いて通信を行うことにより、上記のパケット喪失率の改善を図ることを最も主要な特徴とし、従来技術とは、移動局が必ずしも最も近い無線基地局と通信しない点が異なる。これは、移動局にとってパケット送出を行う許可の要求を複数の無線基地局に対し行うことになるので、送出可能なスロットを得られる確率が上がる。また、各基地局も空いているスロットが、使われる確率をこの方法により上げることができるので、周波数の有効利用につながる。

## 【0008】

【発明の実施の形態】図2に本発明の第一の実施例を示す。移動局或いは無線基地局で送出すべきパケットが生じたときに、まずバッファへ書き込み一時記憶する。PRMAでは、予め定めた時間以上時間が経過したデータは、廃棄され喪失パケットとなるので、バッファはその予め定めた時間分の記憶ができる有限な容量でよい。バッファ内のデータ、即ち送出すべきデータがあるときには、それを無線パケットとして送出するためのスロット

の割り当てをおこなう。図2において動作100～124は図5の動作と同じであり、点線で囲んだ動作130～136が本発明の特徴部分である。

【0009】図3に示す様に、送出すべきデータが連続してある場合、あるスロットが割り当てられるとそのスロットを引き続き使用して連続したデータを送出する。送出すべきデータが一時的に無くなった場合にはそのスロットは開放し、他の通信に供与する。同図では移動局1がフレーム2で送出すべきデータが無くなり、フレーム3で開放されたスロットを用いて移動局3が無線パケットを送出している。

【0010】ここで、送出すべきデータがあるにもかかわらず、使用可能なスロットがない、或いは送出許可が得られないために、スロットの割り当てが行われなかった場合には、図2の中の本発明の部分に記すように、他の通信可能な無線基地局の有無を調べ、他に通信可能な無線基地局があれば、通常のPRMAの手順によりスロットの割り当てを行う。移動通信システムでは通常、移動局の管理を行うために、制御信号を連続的に、或いは間欠的に送信している。移動局はこの信号が受信できる

か否かで、他の通信可能な無線基地局の有無を知ることができる。

【0011】尚、無線基地局側から移動局宛へ送出すべきデータがある場合にも、ネットワーク側で同様の処理を行うことにより、本発明を適用することができる。

【0012】図4に、本発明の効果を確認するための計算機シミュレーション結果を示す。ここでは、平均パケット連続送出時間=1/3秒、平均パケット停止時間=1/2秒、許容パケット待ち時間(送出を待つ時間の上限)=15フレーム、1フレーム長=8ミリ秒、1フレームあたりのスロット数(同時に通信できるユーザ数)=12とした。この、シミュレーション条件では、従来技術でのパケット喪失率は20以上のユーザが通信を行うと、パケット喪失率が急激に増加してしまうが、本発明を適用したシステムでは30ユーザ程度まで、パケット\*

\*ト喪失率の増加を抑えられる。例えば、2%までのパケット喪失率を許容すると、従来技術では、1フレームあたりのスロット数の2倍の24ユーザまでしか収容できなかったが、本発明により、1フレームあたりのスロット数の約3倍の31ユーザまで収容することができるようになることが分かる。

【0013】以上は、パケット通信方式の代表的なプロトコルであるPRMAへの本発明の適用であったが、他の無線パケットへも適用可能である。

10 【0014】

【発明の効果】以上に説明したように、無線パケット通信を行うシステムにおいて、本発明により、通信可能な複数の無線基地局を調べる手順を加えることにより、他の制御手順であるPRMA等のパケット通信プロトコルを変えずにそのまま用いて、トラヒックが高い場合に生じるパケット喪失率の増加を低減することができる。更にパケットのスループットが向上すると共に、平均空きスロット数が減少するので、周波数利用効率が高くなる。

20 【図面の簡単な説明】

【図1】本発明の背景と、基本的なアイデアを説明する図である。

【図2】本発明の第一の実施例を示す図である。

【図3】スロットの占有、開放を説明する図である。

【図4】本発明の効果を定量的に示す図である。

【図5】従来の技術を説明する図である。

【符号の説明】

1 基地局1

1a 基地局1のサービスエリア

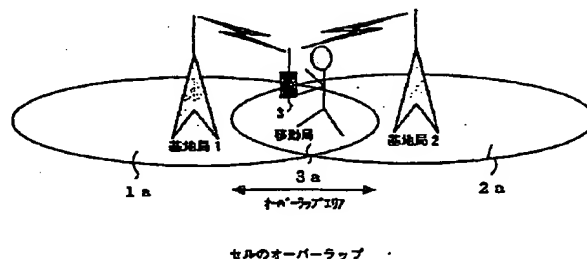
2 基地局2

2a 基地局2のサービスエリア

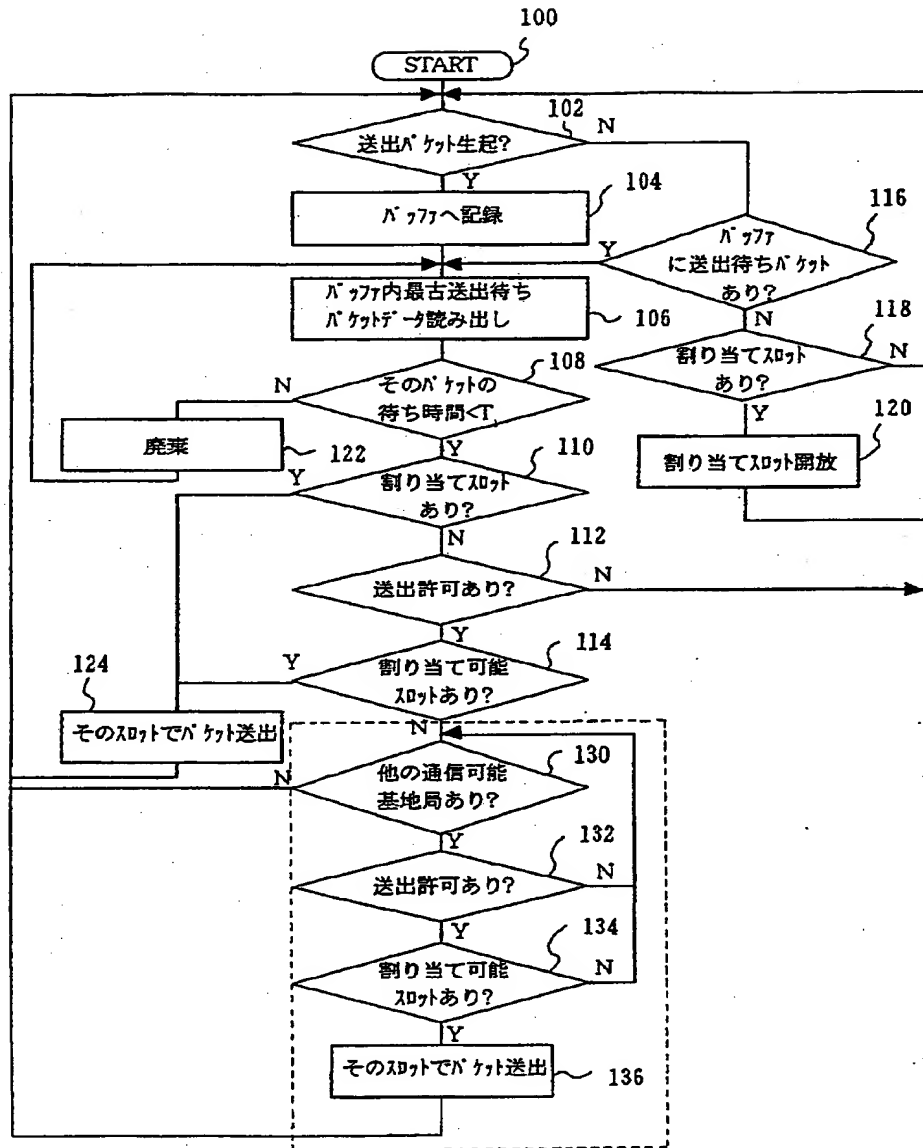
3 移動局

3a サービスエリア1aと1bのオーバーラップエリア

【図1】



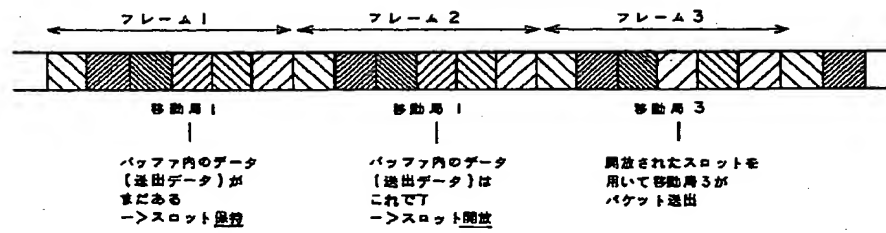
【図2】



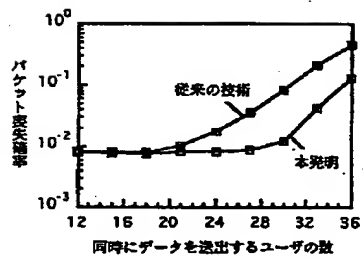
スロット及び基地局選択アルゴリズム



【図3】

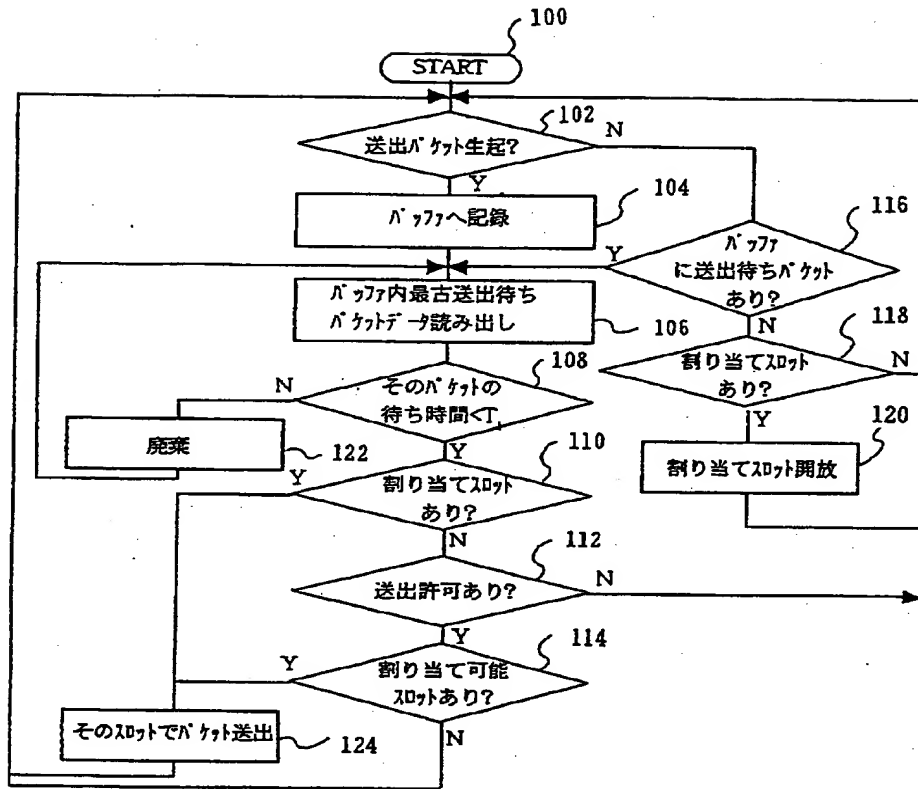


【図4】



本発明の効果を説明する図

【図5】



従来のスロット割り当てアルゴリズム